most remote part of Yezo visited, a region which had scarcely been traversed by the Japanese. Here the Ainu were found to be more hairy than elsewhere, and to present many Aryan features in their general appearance. One peculiar fact brought out by many measurements was the remarkable length of their arms. The measurement across the outstretched arms is always from three to five inches more than the height of the individual. The future capital of Hokkaido (the name given to Yezo and the Kurile Islands collectively) is to be erected on the Kamikawa plain, in the very centre of Yezo, and roads are being pushed forward to connect it with all parts of the coast. It will, when completed, take the place of the present capital, Sapporo. According to Japanese maps, Mr. Landor's journey extended to 5000 miles, but his own reckoning puts it as 3800; almost the whole distance was done on horseback.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—By the death of Prof. Westwood on January 2 the University lost one of the most learned of its members, and another link with the earlier study of science in Oxford is gone. Prof. Westwood became Hope Professor on the foundation of the chair by the Rev. F. W. Hope in 1861, and afterwards devoted his time to the perfecting of the collection which Mr. Hope bestowed on the University. The collection, which has received considerable additions from other sources, including the Burchell collection, Wallace's types, &c., has attained somewhat unmanageable proportions, and its present quarters are too small for its proper display. Whoever succeeds to the chair, it is to be hoped that suitable provision will be afforded to enable him to make the collection of more use to University studies than has hitherto been the case.

In November last an examination for a Radcliffe Travelling Fellowship, thrown open, *pro hac vice*, to all branches of natural science, was held, but the result has not yet been announced. It is now announced that an examination will be held during this term for a second Radcliffe Fellowship, the subjects being strictly medical. It is believed that the results of the two examinations will be published together at the end of this term. There is some dissatisfaction at the delay in announcing the result of the first examination.

Prof. Ray Lankester has recovered from the illness which necessitated his absence from Oxford last term, and has resumed his lectures on the Vertebrata and a senior course on the Arachnida.

The Mathematical Scholarships and Exhibitions have been awarded as follows:—

Senior Mathematical Scholar, R. C. Fowler, B.A., of New College.

Proxime Accessit, S. F. White, B.A., of Wadham College, to whom the Examiners have awarded Lady Herschell's book.

Junior Mathematical Scholar, C. B. Underhill, Balliol College.

Junior Mathematical Exhibition, J. F. McKean, Hertford College.

Proxime Accessit, W. C. Childs, Corpus Christi College.

The Duchess of Marlborough has bestowed on the Chemical Department the entire collection of chemical and electrical apparatus belonging to the late Duke. The collection, which includes two exceptionally fine spectroscopes, delicate balances, &c., has been brought to the Museum from Blenheim, and forms a valuable addition to the Chemical Laboratory.

Mr. E. L. Collis, of Keble, is President, and Mr. M. D. Hill, of New College, is Treasurer of the Junior Scientific Club this term, and Messrs. C. H. H. Walker, of University College, and T. H. Butler, of Corpus Christi, are respectively Chemical and Biological Secretaries. The first meeting is held on Wednesday, February 1, when Mr. J. E. Marsh exhibits some products of the electrical furnace, and Messrs. Finn and Fremantle read papers on East Africa and Hermaphroditism.

At a meeting of the Biological Club, on Saturday last, Mr. G. C. Bourne read a paper on the influence of the nucleus on the cell.

CAMBRIDGE.—The Senate have resolved to appoint a Demonstrator in Palæozoology in connection with the Geological Department. He will have no stipend from the University, but will be remunerated from the fees paid by students.

Dr. Allbutt, Regius Professor of Physic, Dr. A. MacAlister, Professor of Anatomy, and Dr. Donald MacAlister, University Lecturer in Medicine, have been appointed to represent the University at the Eleventh International Medical Congress to be held at Rome in September next.

Dr. W. H. Gaskell has been appointed a member of the Special Board for Medicine, and Mr. C. T. Heycock a member of the Special Board for Physics and Chemistry. Dr. Ransome, F.R.S., Honorary Fellow of Gonville and Caius College; Dr. Corfield, F.R.S, Professor of Hygiene and Public Health in University College, London; Dr. J. Lane Notter, Professor of Military Hygiene at Netley; and Dr. Thorne Thorne, F.R.S., Medical Officer to H.M. Local Government Board, have been appointed Examiners in State Medicine for the Diploma in Public Health during the current year.

Sir G. G. Stokes and Dr. Hobson have been elected Examiners for the Adams Memorial Prize to be awarded in 1895.

Mr. E. H. Acton, of St. John's, and Mr. T. H. Easterfield, of Clare, have been approved as Teachers of Chemistry with reference to the regulations for medical and surgical degrees.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 15, 1892.—"Experiments on the Action of Light on *Bacillus anthracis*." By Prof. Marshall Ward, F.R.S.

It is abundantly evinced by experiments that direct insolation in some way leads to the destruction of spores of *Bacillus anthracis*, and in so far the results merely confirm what had already been discovered by Downes and Blunt in 1877 and 1878.[1]

From the fact that an apparent retardation of the development of the colonies on plates exposed to light was observed several times under circumstances which suggested a direct inhibitory action of even ordinary daylight, the author went further into this particular question with results as startling as they are important, for if the explanation given of the phenomena observed in the following experiments turns out to be the correct one, we stand face to face with the fact that by far the most potent factor in the purification of the air and rivers of bacteria is the sunlight. The fact that direct sunlight is efficacious as a bactericide has been long suspected, but put forward very vaguely in most cases.

Starting from the observation that a test-tube, or small flask containing a few c.c of Thames water with many hundreds of thousands of anthrax spores in it may be entirely rid of living spores by continued exposure daily for a few days to the light of the sun, and that even a few weeks of bright summer daylight —not direct insolation—reduces the number of spores capable of development on gelatine, it seemed worth while to try the effect of direct insolation on plate-cultures to see if the results could be got more quickly and definitely.[2]

Preliminary trials with gelatine plate-cultures at the end of the summer soon showed that precautions of several kinds were necessary. The direct exposure of an ordinary plate-culture to the full light of even a September or October sun, especially in the afternoon, usually leads at once to the running and liquefaction of the gelatine, and although the exposed plates eventually showed fewer anthrax colonies than similar plates not exposed, the matter was too complicated to give satisfactory results. Obviously one objection was that the spores might have begun to germinate, and the young colonies killed by the high temperatures.

Experiments made in October with gelatine plates wrapped in black paper, in which a figure—a square, cross, or letter—was cut, also led to results too indefinite for satisfaction, although it was clear in some cases that if the plates lay quite flat, the illuminated area was on the whole clear of colonies, while that part of the plate covered by the paper was full of colonies.

But another source of vexation arose. After the plates had been exposed to the sunlight for, say, six hours, it was necessary to put them in the incubator (20°–22° C. was the temperature used) for two days or so, to develop the colonies, and in many cases it was observed that by the time the colonies were sufficiently far advanced to show up clearly, liquefaction had extended so far as to render the figure blurred and doubtful.

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[1] See p. 237 of "First Report to the Water Research Committee of the Royal Society" ("Roy. Soc. Proc." col. 51, 1892) for the literature on this subject up to 1891.

[2] It appears that Buchner (*Centr. f. Bakt.* vol. xii. 1892) has already done this for typhoid, and finds the direct rays of the summer sun quite effective.

Stencil plates of zinc were employed with, at first, equally uncertain results. The stencil plate was fixed to the bottom of the plate culture, outside, and every other part covered with blackened paper: the plate was then placed on a level surface, the stencil-covered face upward, and exposed to the direct sunlight. As before, the gelatine softened and in many cases ran, and the results were uncertain, though not altogether discouraging.

In November it was found that more definite results could be obtained, and the problem was at last solved.

Meanwhile it had already been found possible to obtain sun prints in the following way with agar plates. Ordinary agar was heated and allowed to cool to between 50° and 60° C., and was then richly infected with anthrax spores, and made into plates as usual. Such plates were then covered with a stencil plate on the lower face—the stencil plate being therefore separated from the infected agar only by the glass of the plate—and wrapped elsewhere closely in dull black paper, so that, on exposure to the sun only the cut-out figure or letter allowed the solar rays to reach the agar.

Such plates were then exposed to the direct rays of the October sun for from two to six hours; or they were placed on the ring of a retort-stand, stencil downwards, and the sunlight reflected upwards from a plane mirror below.

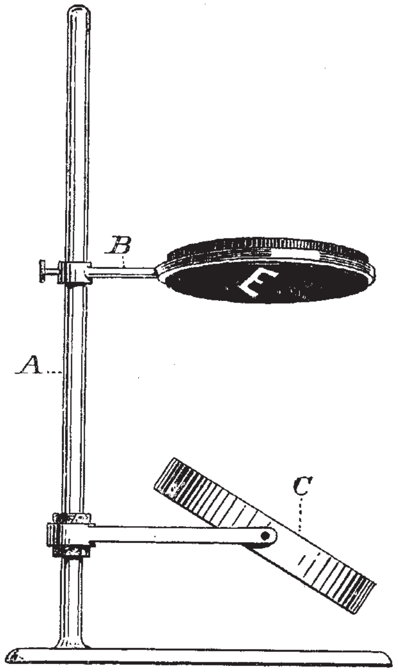

FIG. 1.

After the insolation these plates were incubated for at least forty-eight hours at 20° C., and on removing the wrappers the colonies of anthrax were found densely covering all parts of the plate except the area—a letter or cross, &c.—exposed to the sunlight. There, however, the spores were killed, and the agar remained perfectly clear, showing the form of a sharp transparent letter, cross, &c., in a groundwork rendered cloudy and opaque by the innumerable colonies of anthrax.

Experiments proved that this was not due to high temperature, for a thermometer with its bulb next the insolated glass rarely rose beyond 14° to 16° C., and never beyond 18° C., and even if the thermometer did not record the temperature inside the plate, this can scarcely have been much higher.

As long as this latter point remained uncertain, however, the experiments could not be regarded as satisfactory; whence it was necessary to again have recourse to gelatine cultures. The gelatine employed began to run at 29° C., and in November it was found that such plates exposed outside, either to directly incident sunshine, or to directly reflected rays, showed a temperature of 12° to 13° C. at the insolated glass surface, and even five to six hours exposure caused no running of the gelatine.

The following experiment may be selected as a type of the rest:—A (Fig. 1) is the upright of an ordinary retort-stand; on the ring B rested a gelatine plate culture of anthrax spores, covered with black paper everywhere except the cut-out letter E, seen on its lower face. C was an ordinary plane microscope-mirror with its arm fitted to a cork on A.

The whole was placed in the middle of a field at 9.30 a.m. on Wednesday, November 30, and exposed to the clear, but low, sunshine which prevailed that day, the mirror being so arranged (from time to time as necessary) as to reflect the light on the E the whole period, until 3.30 p.m., when the plate was removed and placed in the dark incubator at 20° C. On the following Friday—*i.e.* after less than forty-eight hours' incubation—the letter E stood out sharp and clearly transparent from the faint grey of the rest of the plate of gelatine. Not a trace of anthrax could be found in the clear area, even with the microscope, while the grey and almost opaque appearance of the rest of the plate was due to innumerable colonies of that organism which had developed in the interval.

It was impossible to incubate the plate longer for fear of liquefaction, whence the sceptical may reply that the anthrax exposed to light was only retarded; the experiments with agar show that such is not the case, however, and that if the insolation is complete the spores are rendered incapable of germinating at all, as proved by removing pieces of the clear agar or gelatine and attempting to make tube cultures from them: in all cases where insolation is complete they remain sterile.

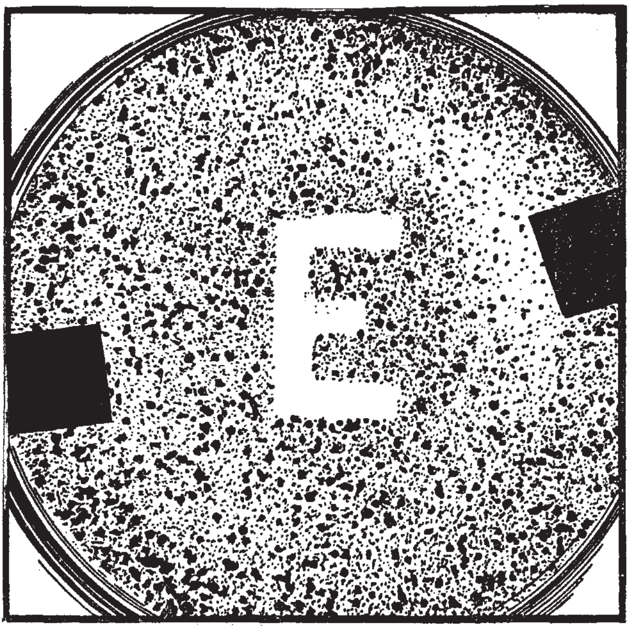

FIG. 2.

The chief value of these gelatine plate exposures in November, however, is that they prove conclusively (1) that the rays of a *winter* sun are capable, even if reflected, of killing the spores, and (2) that it is really the solar rays which do this directly, and not any effect of a higher temperature, since the gelatine remains solid throughout.

Experience has shown, however, that some precautions are necessary in selecting the anthrax cultures employed for these experiments with gelatine. The light certainly retards or kills (according to its intensity or the length of exposure) virulent spores, but if one takes the spores, mixed with vegetative bacilli, direct from a thoroughly liquefied gelatine culture, or from a bouillon culture, the plates are apt to be liquefied too rapidly for the proper development of the light print, evidently because so much of the liquefying enzyme is carried in when inoculating the plates. The same danger is run when active bacilli alone are employed.

The best method of avoiding these disadvantages has been found to be the following, and it has the additional merit of enabling us to prove, beyond all doubt, that the ripe spores of *Bacillus anthracis* are really inhibited or killed by sunlight.

A few c.c. of sterile distilled water in a tube are thoroughly saturated with the anthrax spores taken from an old culture which has never been exposed to light, and the tube placed for twenty-four hours at 56° C.; this kills all immature spores, bacilli, and enzymes, and leaves us with a crop of the most resistant and fully matured virulent spores.

Experiments with such spores have been made to determine the relative power of the different rays of the spectrum to destroy the anthrax.

It is necessary to note first, however, that in experimenting with the electric light, although but few exposures have been made as yet, it is evident that its effects are feebler than those of the winter sun.

At present it has only been possible to observe that the inhibiting effects are stronger at the blue end of the spectrum than at the red, and exposures to sunlight passing through coloured glasses confirm this result; but the observations are being continued in the hope of getting a perfectly sharp record of the effects of each set of rays.

The following series of experiments are quoted in detail, because they teach several details of importance, in addition to proving the main fact.

On December 7 three gelatine plates and five agar plates were prepared with spores from a very vigorous and virulent agar tube of anthrax. The spores, which were quite mature, were not subjected to heat, but simply shaken in sterile water to wash and separate them thoroughly.

The three gelatine plates were made at 35° C., the agar plates at 60° C., neither of which temperatures could injure the ripe spores.

The three gelatine plates were labelled *p* 1, *p* 2, and *p* 3, and the agar plates *p* 4 to *p* 8 in order.

Immediately after making the plates, all were exposed to the December sun, except plates *p* 4, *p* 5, and *p* 6, and this was done as follows:—In each case the plate had a stencil plate with a cut-out letter on its lower face, and arranged as described above.

p 1, a gelatine plate with a *large* letter M, was exposed, face down, to the light reflected from a mirror (see Fig. 1) for three hours on December 7, and for four hours on December 8, the interval being passed in a cold room (*t* about 8°–9° C.), and then incubated at 20° in the dark.

p 8 was treated in exactly the same manner. But this was an agar plate with a *large* W.

p 2, a gelatine plate with a *large* H, was exposed and heated in the same way, except that no mirror was used, the latter being upwards towards the sun.

p 3, a gelatine plate with a *large* B, was similarly exposed, face up, but a plane mirror arranged to reflect light down upon it.

p 7, an agar plate with a *large* E, was treated exactly as the last.

There now remain the three agar plates, *p* 4, *p* 5, and *p* 6, to account for.

p 4 was placed forthwith in the dark incubator at 20° C.

p 5 and *p* 6 were kept for eighteen hours in a drawer, the average temperature of which is almost 16° C., and were not exposed till next day (December 8), when they lay for five hours, face upwards, and with a mirror above them. *p* 5 had a *small* E, and *p* 6 a broad but small I to let the light in.

After exposure, these also were put in the same incubator with the others.

Nothing was visible to the unaided eye on these plates (except *p* 4) until the 11th instant, though the microscope showed that germination was proceeding on the 10th. The plate *p* 4, however, had a distinct veil of colonies all over it on the 9th, and this had developed to a dense typical growth by the 11th.

On December 11, at 10 a.m., the state of affairs, as regards the exposed plates, was as follows:—

p 5 and *p* 6 showed each a sharp transparent letter—E and I respectively—of clear agar in a dull grey matrix of strong anthrax colonies, which covered all the unexposed parts of the plate.

p 1, *p* 2, and *p* 3 showed in each case a perfectly clear central patch, about 1½ inches diameter, with anthrax colonies in the gelatine around. These anthrax colonies were the *larger and more vigorous the more distant they were from the clear centre.* In other words, the anthrax spores had begun to germinate, and the colonies were growing more vigorously, in centripetal order.

On *p* 7 and *p* 8 germination was beginning, but the colonies were as yet too young to enable one to judge of the results.

The first point of interest is to account for the pronounced results in the plates *p* 5 and *p* 6, and the want of sharp outlines in *p* 1, *p* 2, and *p* 3, and the explanation seems to be that, owing to the plates 5 and 6 having laid over night at 16° C., the spores began slowly to germinate out, *and were consequently in their most tender condition* when exposed to the sunlight next day.

The peculiar centripetal order of development of the colonies on plates *p* 1, *p* 2, and *p* 3 gave rise to the following attempt at explanation. After observing that the clear space in the middle was not due to the centre of the plate being raised, and the infected gelatine having run down to the periphery—a possible event with some batches of Petrie's dishes—it was surmised that the *large* letters employed might give the clue.

This was found to be the case. The solar rays on entering the plate were largely reflected from the glass lid of the plates, and so produced feebler insolation effects on parts of the plate around the letter; these effects were naturally feebler and feebler towards the margin, and so the inhibitory action became less pronounced at distances further and further removed from the centre. Those spores, therefore, which were nearest the periphery germinated out first, and those nearer the centre were retarded and more and more in proportion to their proximity to the insolated letter.

That this is the correct interpretation of the facts follows clearly from the further behaviour of the above plates.

At 10 p.m. on the 11th—*i.e.* twelve hours after the morning examination—the plates *p* 1, *p* 2, and *p* 3 exhibited their respective letters M, H, and B quite clearly, in the grey matrix of anthrax which had rapidly developed in the interval, and excepting a slight want of sharpness in the H of *p* 2, the results could hardly have been more satisfactory.

In *p* 7 and *p* 8 the *very faint* outlines of the letters were also showing.

On the 12th, at 8.30 a.m., the gelatine plates had begun to run, and although the M of *p* 1 was still intact, and very well marked, *p* 2 had liquefied completely, so that the H was a clear patch with blurred outlines in the centre. *p* 3 still showed the outlines of the B, but it was impossible to keep it longer.

The main point was definitely established, however, and the treatment of the plates proves conclusively that the spores are not killed by high or low temperatures, *but by the direct solar rays.*

These experiments are being continued in order to answer some other questions in this connection.

The gelatine and agar after such exposures as have been described are still capable of supporting a growth of *B. anthracis* if fresh spores are sown on them, whence the effects described are not merely due to the sub-strata being spoilt as food material.

Royal Meteorological Society, January 18.—Dr. C. Theodore Williams, President, in the chair.—After the report had been read, and the officers and council for the ensuing year had been elected, the President delivered an address on the high altitudes of Colorado and their climates, which was illustrated by a number of lantern slides.—Dr. Williams first noticed the geography of the plateaux of these regions, culminating step by step in the heights of the rocky mountains, and described the lofty peaks, the great parks, the rugged and grand cañons, and the rolling prairie, dividing them into four classes of elevations between 5000 and 14,500 feet above sea level. He then dwelt on the meteorology of each of these divisions; giving the rainfall and relative humidity, and accounting for its very small percentage by the moisture being condensed on the mountain ranges of the Sierras lying to the west of the Rockies; also noticing the amount of sunshine and of cloudless weather, the maxima and minima temperatures, the wind force, and the barometric pressure. Dr. Williams quoted some striking examples of electrical phenomena witnessed on Pike's Peak (14,147 feet) by the observer of the U.S. Weather Bureau, when during a violent thunderstorm flashes of fire and loud reports, with heavy showers of sleet, surrounded the summit in all directions, and brilliant jets of flame of a rose-white colour jumped from point to point on the electric wire, while the cups of the anemometer, which were revolving rapidly, appeared as one solid ring of fire, from which issued a loud rushing and hissing sound. During another storm the observer was lifted off his feet by the electric fluid, while the wristband of his woollen shirt, as soon as it became damp, formed a fiery ring around his arm. The climate of the Parks is, however, Dr. Williams considered, of more practical interest, and in these magnificent basins of park-like country interspersed with pines, and backed by gigantic mountains, are resorts replete with interest for the artist, the sportsman, the man of science, and the seeker for health. Most of them lie at heights of from 7000 to 9000 feet, and so good is the shelter that usually snow does not long remain on the ground, while Herefordshire cattle in excellent condition are able to fatten on the good herbage, and to lie out all the winter without shed or stable. Dr. Williams predicted for these parks a great future as high altitude sanitaria for the American continent, especially as several of them have been brought within easy distance of Denver, the queen city of the plains, by various lines of railway. The resorts on the foothills and on the prairie plains, at elevations of 5000 to 7000 feet, include, besides Denver, Colorado Springs, Manitou, Boulder, Golden, and other health stations, which can be inhabited all the year round, and where most of the comforts and luxuries of American civilisation are attainable in a climate where not more than half a day a week in winter is clouded over, where the rainfall is only about 14 inches annually, most of which falls during summer thunderstorms, where the sun shines brightly for 330 days each year, and where the air is so transparent that objects twenty miles off appear close at hand, and high peaks are calculated to be visible at a distance of 120 miles. Dr. Williams summed up thus :—The chief features of the climate of Colorado appear to be (1) Diminished barometric pressure, owing to altitude, which, throughout the greater part of the State, does not fall below 5000 feet. (2) Great atmospheric dryness, especially in winter and autumn, as shown by the small rainfall and low percentage of relative humidity. (3) Clearness of atmosphere and absence of fog or cloud. (4) Abundant sunshine all the year round, but especially in winter and autumn. (5) Marked diathermancy of atmosphere, producing an increase in the difference of sun and shade temperatures, varying with the elevation in the proportion of 1° for every rise of 235 feet. (6) Considerable air movement, even in the middle of summer, which promotes evaporation and tempers the solar heat. (7) The presence of a large amount of atmospheric electricity. Thus the climate of this state is dry and sunny, with bracing and energising qualities, permitting outdoor exercise all the year round, the favourable results of which may be seen in the large number of former consumptives whom it has rescued from the life of invalidism and converted into healthy active workers ; and its stimulating and exhilarating influence may also be traced in the wonderful enterprise and unceasing labour which the Colorado people have shown in developing the riches, agricultural and mineral, of their country.

Entomological Society, January 18.—Sixtieth Annual Meeting.—Mr. Frederick DuCane Godman, F.R.S., President, in the chair.—An abstract of the treasurer's accounts having been read by Mr. J. Jenner Weir, one of the auditors, the secretary, Mr. H. Goss, read the report of the Council. After the ballot it was announced that the following gentlemen had been elected as officers and Council for 1893 :—President, Mr. Henry J. Elwes ; Treasurer, Mr. R. McLachlan, F.R.S. ; Secretaries, Mr. Herbert Goss and the Rev. Canon Fowler ; Librarian, Mr. George C. Champion ; and as other members of the Council, Mr. C. G. Barrett, Mr. Charles J. Gahan, Mr. F. DuCane Godman, F.R.S., Mr. Frederic Merrifield, Mr. Osbert Salvin, F.R.S., Dr. David Sharp, F.R.S., Colonel Charles Swinhoe, and Mr. George H. Verrall. The President then delivered an address which, though containing reference to the Society's internal affairs and an allusion to the successful resistance made by naturalists and others to the War Office scheme for establishing a rifle-range in the New Forest, consisted for the most part of full obituary notices of Fellows of the Society who had died during the year, special mention being made of Mr. Henry W. Bates, F.R.S., Prof. Hermann C. C. Burmeister, Dr. Carl A. Döhrn, Mr. H. Berkeley-James, Mr. J. T. Harris, Sir Richard Owen, K.C.B., F.R.S., Mr. Henry T. Stainton, F.R.S., Mr. Howard Vaughan, and Prof. J. O. Westwood, the Hon. Life President. Votes of thanks to the President and other officers of the Society having been proposed by Lord Walsingham, F.R.S., and Dr. D. Sharp, F.R.S., and seconded by Mr. J. H. Leech and Mr. W. H. B. Fletcher, Mr. Godman, Mr. McLachlan, Mr. H. Goss, and Canon Fowler severally replied, and the proceedings terminated.

Linnean Society, January 19.—General Meeting, Prof. Charles Stewart, President, in the chair.—After the confirmation of the minutes the President referred in suitable terms to the losses sustained by biologic science in the deaths of Sir Richard Owen and Prof. J. O. Westwood, who had been Fellows of the Society for 56 and 64 years respectively.—Mr. George Brook showed photographs of corals which he had lately taken and had reproduced by permanent process at a cost below lithography, with the added advantage of permitting amplification by a hand lens.—The President read a paper on the auditory organ of the angel fish (*Rhina squatina*).—Mr. W. Carruthers, F.R.S., V.P.L.S., then laid before the Society the results of a collection made by Mr. Alexander Whyte in the Malanji country, in the Shiré highlands, in October, 1891, and the plants were determined by the officers of the Botanical Department, British Museum, about sixty, or, roughly speaking, one-fifth, proving new to science. Whilst Sir J. D. Hooker defined the flora of Kilimanjaro as Abyssinian in character, the Malanji flora displays a much closer relationship to the Cape.—The last paper was by Mr. G. F. Scott Elliot, and was his report as botanist to the Anglo-French Sierra Leone Boundary Commission, in which he gave an account of the economic aspects of the districts traversed.

Geological Society, January 11.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read :—Variolite of the Lleyn, and associated volcanic rocks, by Catherine A. Raisin, B.Sc. Communicated by Prof. T. G. Bonney, F.R.S. The district in which these rocks occur is the south-western part of the Lleyn peninsula, marked on the Geological Survey map as "metamorphosed Cambrian." Some of the holocrystalline rocks are probably later intrusions. The igneous rocks, which are described in detail in the present paper, belong to the class of rather basic andesites or not very basic basalts ; they show two extreme types, which were probably formed by differentiation from an originally homogeneous magma. Corresponding to the two types of rock are two forms of variolite. These are fully described, and their mode of development is discussed. The variolites occur near Aberdaron, and at places along the coast. Their spherulitic structure often is developed towards the exterior of contraction-spheriods, and in this and in other particulars they correspond with those of the Fichtelgebirge and of the Durance. The volcanic rocks include lava-flows and fragmental masses, both fine ash and coarse agglomerate. They are associated with limestones, quartzose, and other rocks, which are possibly sedimentary, but which give no trustworthy evidence of the age of the variolites. Prof. Judd complimented the authoress on the evidently great amount of labour and patient research devoted to this investigation. He thought the occurrence of the spherulitic structure round the surfaces of "pillow-like masses," similar to those described by Prof. Dana, was exceedingly interesting, especially when one considered the probably very great antiquity of these Caernarvonshire rocks. He thought, also, the suggestion that early crystallised magnetite-grains had formed the nuclei of the spherulites, was a very interesting and probable one. Mr. Alfred Harker, Profs. Bonney, Hull, and J. F. Blake also spoke.—On the petrography of the island of Capraja, by Hamilton Emmons. Communicated by Sir Archibald Geikie, For.Sec.R.S. The rocks of Capraja consist generally of andesitic outflows resting on andesitic breccias and conglomerates. The southern end seems to have formed a distinct centre of volcanic activity, whose products are younger in age and more basic in character than the rocks of the rest of the island, and may be termed "anamesites." The lavas appear to have flowed from a vent at some distance from the cone, which probably occurred here, and gave out highly scoriaceous fragments. In the other parts of the island andesite is almost everywhere formed, with patches of the underlying breccias here and there in the valley bottoms. The chief centre of activity probably lay west of the centre of the island. Petrographical details of the andesites and anamesites, descriptions of the groundmass and included minerals of each, and chemical analyses are given. As regards the age of the constituents, the author arranges them in the following order, commencing with the oldest :—Magnetite, olivine, augite, mica, felspar, nepheline. After the reading of this paper Dr. Du Riche Preller gave an outline of the leading geological and the analogous petrological features of the several islands of the Tuscan Archipelago, of Corsica, Sardinia, the Carrara mountains, and the Maremma hills. The President also spoke.

Zoological Society, January 17.—Sir W. H. Flower, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the society's menagerie during the month of December, 1892.—Mr. F. C. Selous exhibited and made remarks on the head of a hybrid antelope between the Sassaby (*Bubalis lunata*) and Hartebeest (*B. caama*); also a head of a female Koodoo (*Strepsiceros kudu*) with horns, and heads of some other South African antelopes.—Mr. O. Thomas exhibited some examples (from the Baram River, Sarawak, collected by Mr. Hose) of the monkey that he had lately described as *Semnopithecus cruciger*, and stated that, in spite of the confirmation afforded by these specimens, Mr. Hose thought that this species might possibly be only an erythrism of *S. chrysomelas*.—A communication was read from Mr. E. Y. Watson, entitled, "A proposed classification of the *Hesperiidæ*, with a revision of the Genera." This contained a preliminary classification of the *Hesperiidæ*, including the numerous modern genera, which were arranged under three subfamilies according to the sexual differences, the resting posture, the antennæ, the spurs on the hind tibiæ, and the position of vein 5 (relative to veins 4 and 6) of the fore wing. The subfamilies were named Pyrrhopyginæ, Hesperiinæ, and Pamphilinæ, and the two last were subdivided into sections without names. In all 234 generic names were dealt with, of which 49 were treated as synonyms, while 45 new genera were described. Complete diagnoses were given of all the admitted genera.—A communication was read by Mr. E. E. Austen, entitled "Descriptions of New Species of Dipterous Insects of the Family *Syrphidæ*, in the Collection of the British Museum, with Notes on Species described by the late Francis Walker." This communication contained descriptions of twenty-three new species belonging to the division *Bacchini*, and of one belonging to the *Brachyopini* (genus *Rhingia*). An attempt was made to divide the genus *Baccha*, as at present existing, into three groups, based chiefly upon the shape and markings of the abdomen. The true position of the remarkable genus *Lycastrirhyncha*, founded by Bigot on a species from Brazil, and afterwards cancelled by its author in favour of *Rhingia*, was established. It was shown that this genus had nothing to do with *Rhingia*, but was one of the *Eristalini*, closely allied to *Eristalis*. It was also shown that the genus *Lycastris*, founded by Walker for a species from India, was not identical with *Rhingia* (as had been likewise suggested by Bigot), but belonged to the *Xylotini*, and was allied to *Criorrhina*. A communication was read from Mr. Gilbert C. Bourne, containing descriptions of two new species of Copepodous Crustaceans from Zanzibar, proposed to be called *Canthocamptus finni* and *Cyclops africanus*.—Mr. Sclater exhibited and made remarks on the typical specimen of a rare Argentine bird (*Xenopsaris albinucha*) described by the late Dr. Burmeister in 1868.

Anthropological Institute, January 24.—Anniversary meeting.—Dr. Edward B. Tylor, F.R.S., in the chair.—The following were elected officers and council for the ensuing year:—President, Prof. A. Macalister. Vice-Presidents, J. G. Garson, Chas. H. Read, F. W. Rudler. Secretary, C. Peek. Treasurer, A. L. Lewis. Council: G. M. Atkinson, Henry Balfour, E. W. Brabrooke, Hyde Clarke, J. F. Collingwood, Prof. D. J. Cunningham, W. L. Distant, J. Edge Partington, A. J. Evans, H. Gosselan, Prof. A. C. Haddon, T. V. Holmes, R. Biddulph Martin, R. Munro, F. G. H. Price, Oldfield Thomas, Arthur Thomson, Coutts Trotter, M. J. Walhouse, Gen. Sir C. P. Beauchamp Walker.

EDINBURGH.

Royal Society, January 16.—Prof. Copeland, Vice-President, in the chair.—A paper, by Dr. W. Pole, on the present state of knowledge and opinion in regard to colour blindness, was communicated. He discussed alone the red-green form of colour blindness. In such a case the solar spectrum presents only two hues separated by a nearly colourless portion—a mixture of blue and yellow lights giving rise to a gray colour. According to Young the three primary colour sensations correspond to red, green, and blue or violet, and Maxwell and Helmholtz, reasoning on this theory, conclude that the colours seen in dichromic vision are green and blue. According to Dr. Pole, they are yellow and blue. He asserts that comparisons between normal and abnormal visions show that in general matches of colours made by a normal eye are also matches when regarded by a dichromic eye. He concludes that the two dichromic colours are colours known in normal vision. He then gives reasons for the conclusion that these colours are normal blue and yellow. In answer to the suggestion that the real subjective impressions may differ from what they are supposed to be, he says that the correspondence is proved by a large amount of evidence obtained by comparison with normal phenomena. He thinks that the following conclusions may be drawn from the second edition of Helmholtz's work on optics:—(1) The original mode of explanation of colour blindness by Young's theory is essentially withdrawn as no longer consistent with modern knowledge. The universal concurrent testimony, that the ordinary colour dichromic vision generally corresponds with is normal yellow and blue and white, is no longer disputed, and although there are variations of sensations in regard to red and green, the old ideas of blindness to red and green as separate and contrasting defects are abandoned; (2) that Young's general theory of three fundamental colour-sensations is still adhered to, but that the colours are now believed to differ considerably in the spectrum; (3) that dichromic vision might exist consistently with the retention of three fundamentals; (4) that the most prevalent form of dichromatism might be explained by the junction of the red and green fundamentals forming yellow. In conclusion, he regretted that the colour-vision committee of the Royal Society, in a recent chart dealing with colour blindness, had adhered to the old view held by Clerk Maxwell. Sir George Stokes remarked that the fundamental part of Young's original theory was that there were three colour sensations; and though he supposed them to be red, green, and violet, that was not essential. Maxwell only chose red, green, and blue, as representative sensations. He was doubtful of the wisdom of publishing the charts alluded to lest it might lead to misconception. The object of publishing them was to give to the public a general idea of the conclusions derivable from the trichromic theory.

SYDNEY.

Royal Society of New South Wales, December 7, 1892.—Prof. Warren, President, in the chair.—The Chairman announced that the Clarke Medal for 1893 had been awarded by the Council to Prof. Ralph Tate, of the Adelaide University.—A letter was read from the Hon. Ralph Abercromby, enclosing a cheque for £100, which he desired to place in the hands of the Council of the Society with the object of bringing about an exhaustive study of certain features of the Australian weather, the particulars to be furnished in a later letter. The following papers were read:—Observations on shell heaps and shell beds, the significance and importance of the record they afford, by E. J. Statham.—A new mineral from Broken Hill, by C. W. Marsh (communicated by Prof. Liversidge).—Notes on some Australian stone weapons, by Prof. Liversidge, F.R.S.—Notes on the recent cholera epidemic in Germany, by Dr. Schwarzbach.—Results of observations of Wolf's comet II., 1891, Swift's comet I., 1892, and Winnecke's periodical comet, 1892, at Windsor, New South Wales, by John Tebbutt.—On the comet in the constellation Andromeda, by John Tebbutt.—Languages of Oceania, by Dr. John Fraser.

August 17.—*Engineering Section.*—C. W. Darley in the chair.—Papers read:—Various systems of tramway traction, by W. F. How.——November 16.—Some notes on the economical use of steam, by T. H. Houghton.—Recent bridge building in New Zealand, by A. Alabaster.

PARIS.

Academy of Sciences, January 23.—M. Lœwy in the chair.—Note on Nicolas de Kokcharow, by M. Daubrée.—Contributions to the study of the function of camphoric acid, by M. A. Haller.—On the pepto-saccharifiant action of the blood and the organs, by M. R. Lépine. If blood is poured into several parts of water at 56° C. a considerable quantity of sugar is formed in a few seconds, and the formation goes on for about an hour with decreasing rapidity. In cold or lukewarm water sugar is also produced, but its production is for the most part compensated by simultaneous glycolysis. It is also probable that the production of sugar is preceded by that of peptone. If an organ which does not enclose glycogen in any perceptible quantity be macerated for about an hour in three or four parts of water, the aqueous extract only contains a very small quantity of substances capable of reducing Fehling's solution, and hardly any sugar. If to this aqueous extract be added a small quantity of peptone, and the whole be kept at 56°C. during an hour, a certain quantity of sugar is formed, as proved by fermentation and the phenylhydrazine test. Hence the aqueous or glycerine extract contains a ferment which may be termed pepto-saccharifiant. It is probable that the formation of sugar is not confined to the liver, as ordinarily supposed, but that several organs play a part in it.—Observations of the planet Charlois T (December 11, 1892), made at the Toulouse Observatory, by M. B. Baillaud.—Contribution to the investigation of the solar corona apart from total eclipses, by M. H. Deslandres (see Astronomical Column).—Observations of the sun made at the Lyon Observatory (Brunner equatorial) during the latter half of 1892, by M. Guillaume.—On the limitation of degree for the general algebraic integral of the differential equation of the first order, by M. Autonne.—On Van der Waals's equation and the demonstration of the theorem of the corresponding states, by M. G. Meslin.—Magnetic properties of bodies at different temperatures, by M. P. Curie.—The magnetic permeabilities of a series of diamagnetic bodies, including, amongst others, bismuth, antimony, phosphorus, sulphur, and some potassium salts, were determined by enclosing them in an exhausted glass vessel exposed to a magnetic field, and subsequently repeating the experiment with the glass alone. Most of the substances showed a remarkably constant coefficient. Water and quartz did not show a perceptible variation with temperature, and potassium nitrate had the same coefficient when solid and when fused. That of bismuth, on the other hand, fell steadily up to the point of fusion, and then (at 273° C.) abruptly from 0·957 to 0·038, after which it remained constant. Electrolytic antimony had a much feebler coefficient than the ordinary variety.—Contribution to the study of equalisers of potential acting by flow, by M. G. Gouré de Villemontée.—Luminous phenomena observed at the Lyon Observatory on the evening of January 6, 1893, by M. Gonnessiat.—A method for measuring objectively the spherical aberration of the living eye, by M. C. J. A. Leroy.—On the atomic weight of palladium, by MM. A. Joly and E. Leidié.—Action of the alkaline alcoholates on camphoric and other anhydrides, by M. P. Cazeneuve.—Modification of arterial pressure under the influence of pyocyanic poisons, by MM. Charrin and Teissier.—On some cases of infectious arthrodentary gingivitis observed in animals, by M. V. Galippe.—Primary bedding of platinum in the Ural, by M. A. Inostranzeff. The native platinum occurs embedded in a rocky matrix consisting of the variety of peridotite known as dunite. It is found in Mount Solovieff, which consists of alternate layers of chrome-iron and serpentine.—On the existence of overfolds in the Blida Atlas (Algeria), by M. E. Ficheur.

BERLIN.

Physical Society, January 6.—Prof. du Bois Reymond, President, in the chair.—Prof. Raoul Pictet gave an account of experiments made by Messrs. Sarasin and De la Rive by which the rate of the electric waves discovered by Hertz had been measured, and their identity with waves of light in the ether determined. By using large metallic surfaces sixteen metres in diameter as reflectors, and by allowing the discharge of the primary spark to take place under oil instead of in the air, it was found possible to obtain stationary electric waves in a long gallery and to determine their nodal points. In the discussion which ensued Prof. Kundt stated that Dr. Zenker was the first person who had explained the photographing of colours by means of stationary waves; that stationary light-waves were first experimentally determined by Dr. Wiener, and that Seebeck was the first to take photographs of coloured objects. After Prof. H. W. Vogel, pictures due to the action of light were first taken by a doctor named Schulz, in Halle. In 1727 this observer treated a solution of nitrate of silver in a small box with calcium chloride and obtained a greyish precipitate. He then covered the box with a lid in which was a hole the shape of some letter, and on subsequently examining the precipitate he saw a dark image of the letter on it. The experiment was found to fail in the dark. Schulz hence concluded that the image of the letter was due to the action of light.

Meteorological Society, January 10.—Prof. Schwalbe, President, in the chair.—Dr. Kremser spoke on the imperfection of the means available for the study of atmospheric currents, which, even in the most elevated stations, are profoundly modified by the topography of the neighbourhood. The direction and rate of these currents can only be ascertained by observing the motion of a small pilot-balloon of some one cubic metre capacity, a specially constructed theodolite being used for this purpose.—Prof. Hellmann exhibited a series of photographs of snow-crystals taken by Dr. Neuhauss, together with the oldest existing figures of these crystals, due to Olaus Magnus in 1455. The chief points of interest shown by these photographs were the not infrequent asymmetry of the crystals and the occurrence on them of small ice-lumps.

Physiological Society, January 13.—Prof. du Bois Reymond, President, in the chair. Dr. Behring gave an account of the present state of affairs as regards what may be called the blood-serum therapeutists, illustrating his remarks by experiments he had made with serum from an immune horse on mice inoculated with tetanus-bacilli. A number of mice were inoculated with more or less strong doses of the bacilli. Those which had previously been treated with the horse-serum did not die, and in many cases where the serum was injected after the inoculation death did not ensue. Observations on man are in progress, and will be published as soon as sufficient data are to hand on the treatment of tetanus and diphtheria by the use of serum from immune animals.—Dr. Hahn, of St. Petersburg, gave an account of experiments made in conjunction with Profs. Pawlow and Nencki on the action of an Eck's fistula, and the conducting of blood from the portal vein directly into the inferior vena cava. Among the various results of the operation he stated that the output of urea was lessened and that of uric acid increased, a result which the experimenters attributed to a cessation in the conversion of carbamic acid into urea due to exclusion of the liver. They further found that carbamic acid produced symptoms similar to those exhibited by the animals on which they had operated.—Prof. Kossel and Dr. Raps exhibited an automatic mercurial pump for blood-gas analysis.

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